BLD5/10

Brushless DC Motor Drive
User Manual

AMP & MOONS' Automation

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1 Introduction

Thank you for selecting the MOONS' BLD5/10 Brushless DC Motor Drive. The BLD5/10 series DC input drives are based on advanced digital current and velocity control technology and provide high torque, stable velocity and low noise. We hope our dedication to performance, quality and economy will make your motion control project successful.

1.1 Features

- The structure is compact and the parameter is configurable.
- 12-48VDC supply voltage.
- Work in velocity mode.
- Accept analog control signal, digital control signal, RS232/485 communication command or MMI control.
- High response of the PID velocity loop and D/Q current loop control.
- Brushless sinusoidal current control. With motor phase compensation.
- The drive can supply 5/10A (rms) maximum continuously current for each motor phase. And the twice over load 10/20A is allowed for 5 seconds.
- With eight single-ended optically isolated inputs (5-24V) which is configurable for sinking or sourcing by two swtiches, one analog input(0-5V, can be configured by software)and two darlington optically isolated outputs(maxium output current is 80mA).
- Outputs can be configured by 8 functions depending on different requirements.

1.2 Order Information

1.2.1 Numbering System

BLD10 – A – 42BL30L2

Series
BLD Series
5 : 5A
10: 10A

A: RS232
R: RS485

BLDC Motor Type:
42BL30L2
42BL30L4
42BL60L2
42BL60L4
42BL105L2
42BL105L4
57BL60L2
57BL60L4
57BL120L2
57BL120L4
57BL200L4
S*

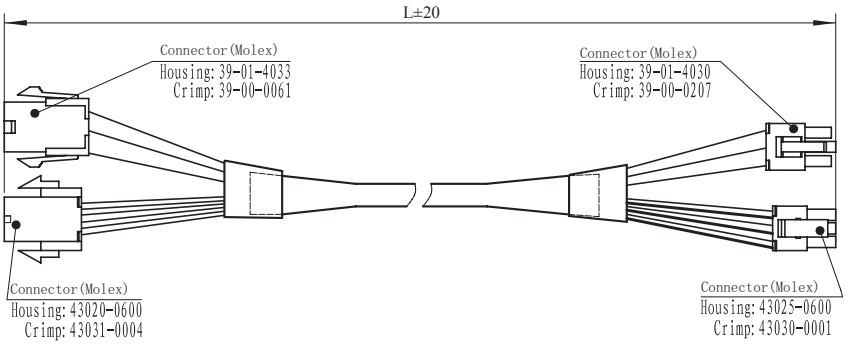
*You can order a drive without a motor.
eg. BLD10-A-S

1.2.2 Order Information

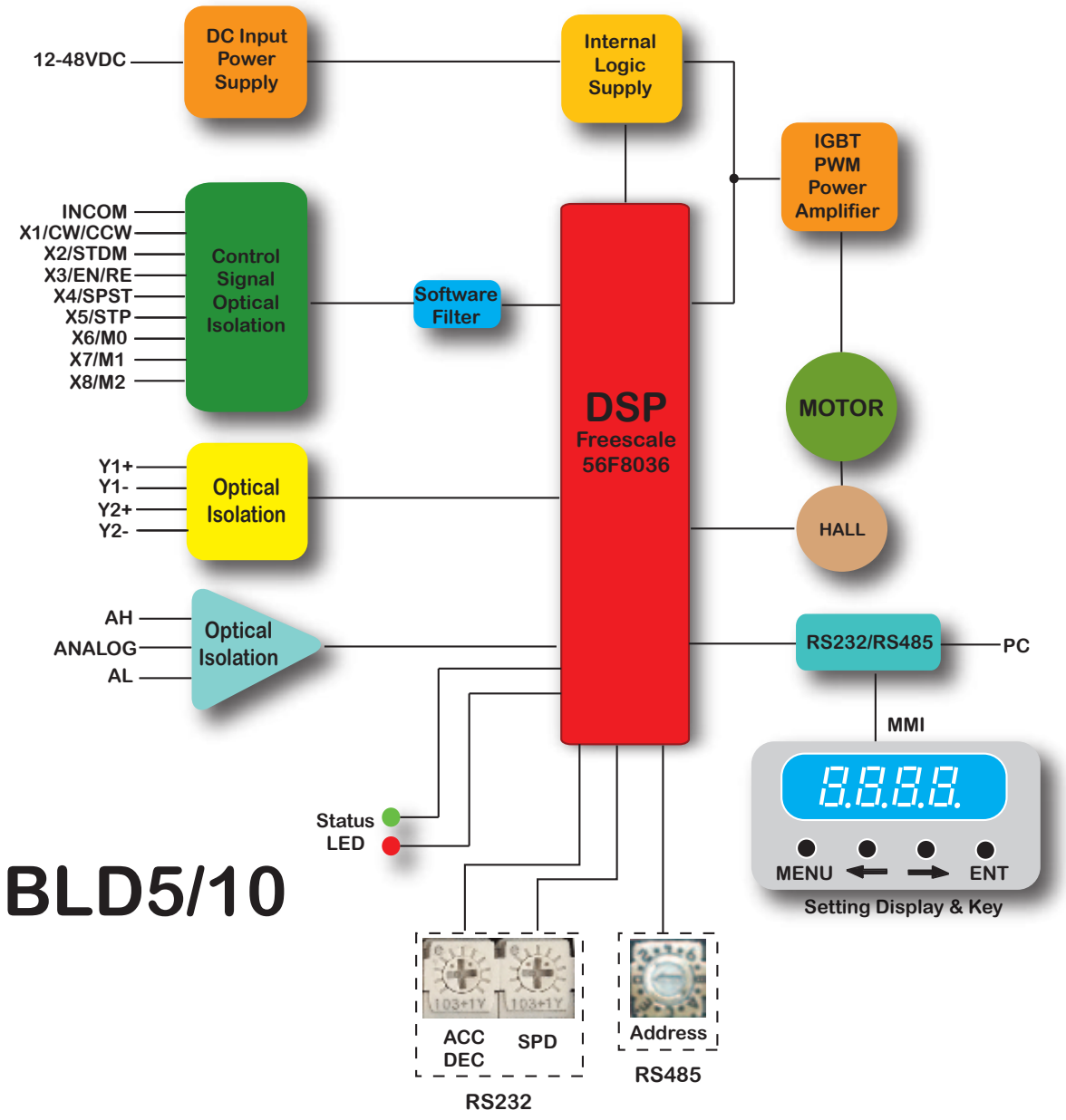
TYPE	Model	TYPE	Model
RS232	BLD5-A-42BL30L2	RS485	BLD5-R-42BL30L2
	BLD5-A-42BL30L4		BLD5-R-42BL30L4
	BLD5-A-42BL60L2		BLD5-R-42BL60L2
	BLD5-A-42BL60L4		BLD5-R-42BL60L4
	BLD5-A-42BL105L4		BLD5-R-42BL105L4
	BLD5-A-57BL60L2		BLD5-R-57BL60L2
	BLD5-A-57BL60L4		BLD5-R-57BL60L4
	BLD5-A-57BL120L4		BLD5-R-57BL120L4
	BLD10-A-42BL105L2		BLD10-R-42BL105L2
	BLD10-A-57BL120L2		BLD10-R-57BL120L2
	BLD10-A-57BL200L2		BLD10-R-57BL200L2

1.2.3 Brushless DC Motor Cable

Part NO.	Length
BLDC-1M	1m
BLDC-3M	3m

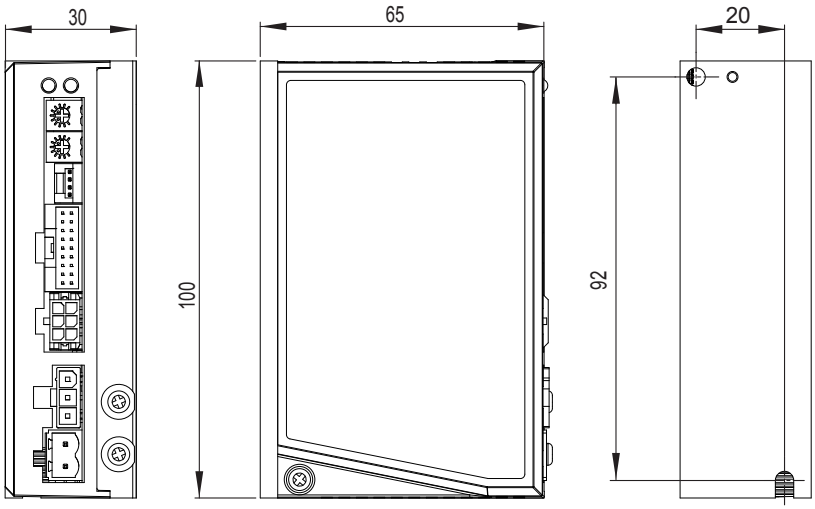


1.3 Block diagram



2 Mounting the Drive

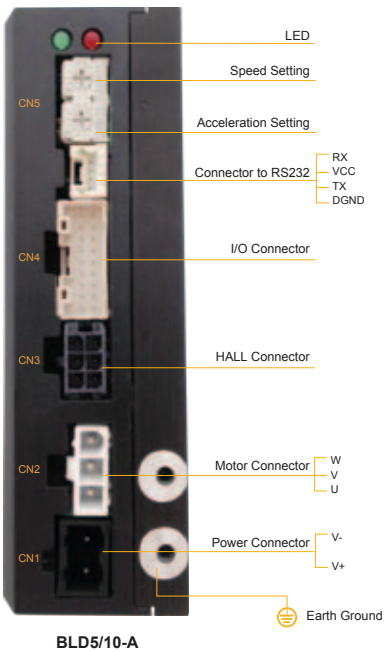
The BLD drive can be mounted only on the narrow side of the chassis. M4 screws should be used in the two holes at the back of the drive.The amplifiers in the drive generate heat. To operate the drive continuously at maximum power forced air cooling, as from a fan, should be provided. Never use the drive in a space where there is no air flow or where other devices can cause the surrounding air to be more than 40 °C. Never put the drive where it can get wet or where metal particles can fall into it.



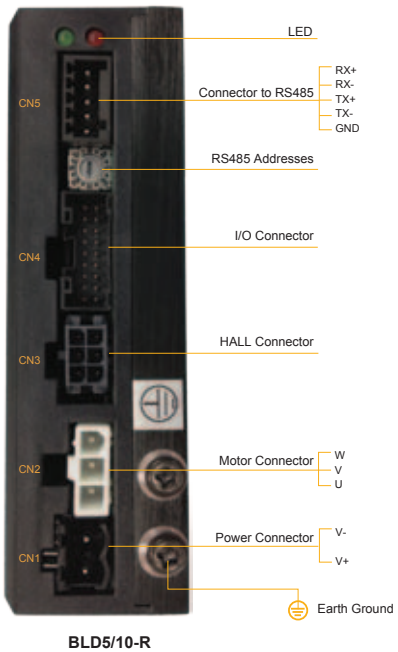
3 Connections

To use the BLD5/10 Drive, the following items are needed:

- DC input of 12 to 48VDC
- Direction, Stop Mode(STMD), Enable, Speed Setting, Stop, Analog or multi-speed setting
- A compatible Brushless Motor



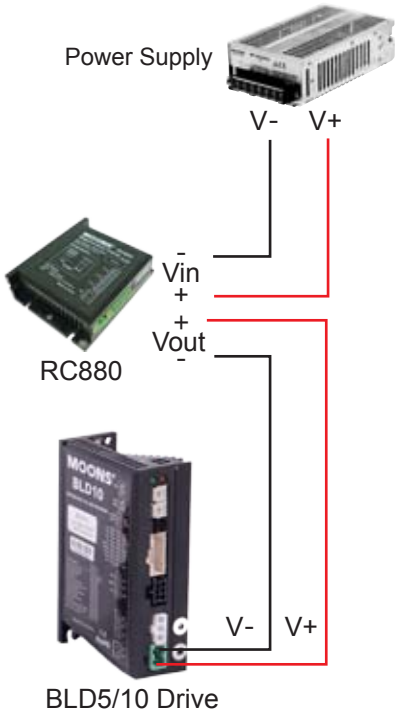
BLD5/10-A



BLD5/10-R

3.1 Connecting the Power(CN1)

Connecting the DC supply to power connector (CN1) according to the diagram on the right. Use 16 AWG wire for V+ and V-. Use 16 AWG for Earth Ground (G).



Care should always be taken when working with voltages.

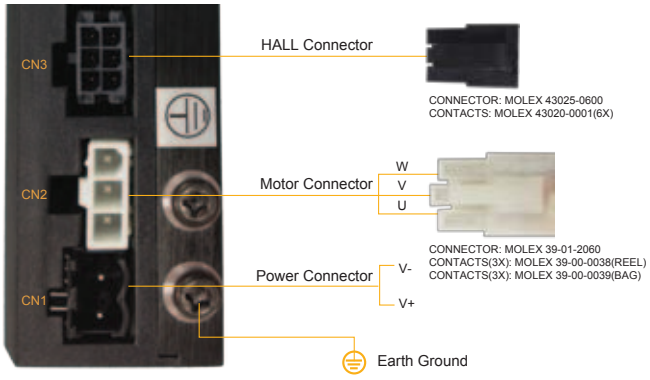
The BLD5/10 contains an internal 15A fast acting fuse.

The BLD5/10 series drives are designed to give optimum performance between 12 and 48 Volts DC. Choosing the voltage depends on the performance requirement and the Motor/Drive heating that is acceptable and/or does not cause a motor/drive overtemperature. Higher Voltages will cause the Motor/Drive to operate at higher temperatures. Using power supplies with Voltage outputs that are near the drive maximum voltage may reduce the operational Duty-cycle significantly. When choosing a Power Supply that is Regulated and is near the Drive Maximum Voltage of 48 Volts, a Voltage Clamp may be required to prevent over-voltage when regeneration occurs. The RC880 used for the Servo/Step Amplifier will also work with the BLD5/10 drive.

If you choose an unregulated power supply, make sure the no load voltage of the supply does not exceed the drive's maximum input voltage specification.

3.2 Connecting the Motor(CN2 and CN3)

Motor connections should be made according to the following diagrams.



3.3 Connecting the BLD5/10 Communications

The BLD5/10 is available with two types of serial communications, RS-232 (BLD5/10-A) or RS-485 (BLD5/10-R). Each type requires a different hardware connection for interface to a PC or other Host system. The RS-232 version comes with a cable that will provide the interface to an RS-232 port through a DB9 style connector. The RS-485 version requires the user to provide both the cabling and the RS-485 interface. Below are descriptions of how to interface both of these serial communication types to a PC.

3.3.1 Connecting to a PC using RS-232(CN5)

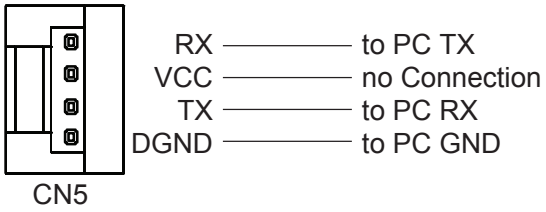
Locate the BLD5/10-A within 1.5 meters of the PC. Plug the DB9 connector of the communication cable that came with the drive into the serial port of the PC. Plug the small end into the PC/MMI jack on the BLD5/10-A . Secure the cable to the PC with the screws on the DB9 connector.

Its baud rate is 9600bps which cannot be changed now.

Note: If the PC does not have an RS-232 serial port, a USB Serial Converter will be needed.

You can contact MOONS' to buy a USB to RS-232 converter.

The RS-232 circuitry does not have any extra electrical "hardening" and care should be taken when connecting to the RS-232 port as hot plugging could result in circuit failure. If this is a concern the RS-485 version should be used.

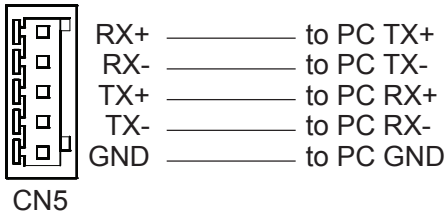


3.3.2 Connecting to a PC using RS-485(CN5)

RS-422/485 communication allows connection of more than one drive to a single host PC, PLC, HMI or other computer. Its baud rate is 9600bps which cannot be changed now. It also allows the communication cable to be long (more than 300 meters or 1000 feet). The use of Category 5 cable is recommended as it is widely used for computer networks, inexpensive, easily obtained and certified for quality and data integrity.

The BLD5/10 can be used with either Two-Wire or Four-Wire RS-422/485 implementation. The connection can be point-to-point (i.e. one drive and one host) or a multi-drop network (one host and up to 16 drives).

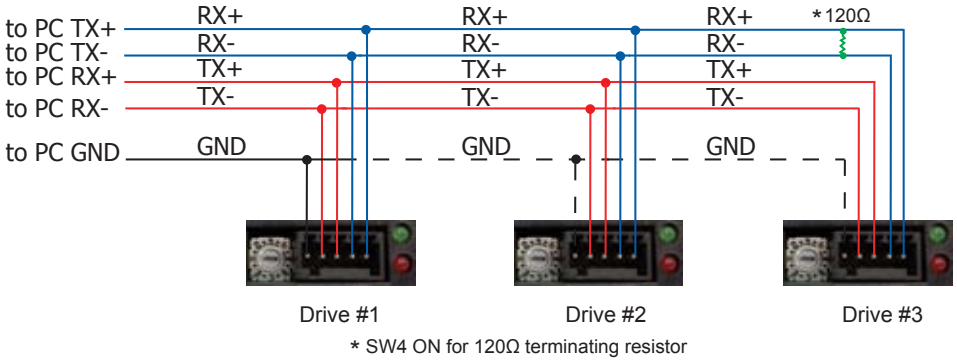
NOTE: To use the BLD5/10 RS-422/485 version with the BLD Configurator software, it must be connected in the Four-Wire configuration (see below)



Four-Wire Configuration

Four-Wire Systems utilize separate transmit and receive wires. One pair of wires must connect the host's transmit signals to each drive's RX+ and RX- terminals. The other pair connects the drive's TX+ and TX- terminals to the host's receive signals. A logic ground terminal is provided on each drive and can be used to keep all drives at the same ground potential. This terminal connects internally to the DC power supply return (V-), so if all the drives on the RS-422/485 network are powered from the same supply it is not necessary to connect the logic grounds. One drive's GND terminal should still be connected to the host computer ground.

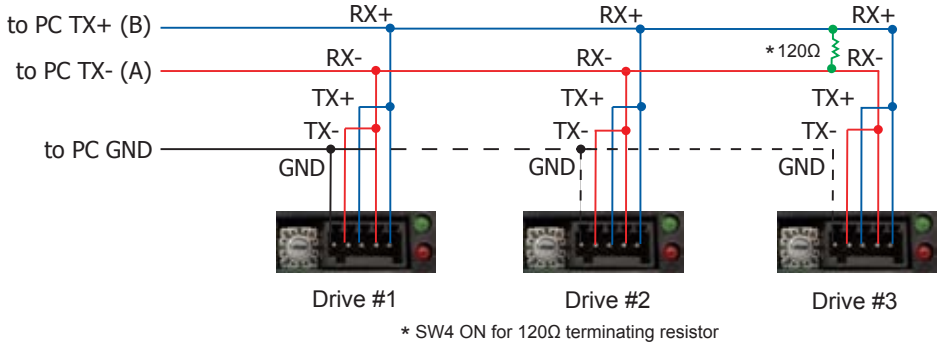
Because the host in a four-wire system never needs to disable its transmitter, software is simplified. Some converters make this process very difficult to implement and can delay communications.



NOTE: If the PC does not have an RS-485 serial port, a converter is required. You can contact MOONS' to buy a USB to RS-485 converter.

Two-Wire Configuration

In a 2-wire system, the host must disable its transmitter before it can receive data. This must be done quickly before a drive begins to answer a query. It is not make the transmit delay in a four wire system.



Assigning Addresses

Before the entire system is wired, each drive will need to connect individually to the host computer so that it can be assigned a unique address.

Once the drive has been connected to the PC as described above, launch the BLD Configurator software. Apply power to the drive. If a drive has already been configured, click the Upload button so that the BLD Configurator settings match those of the drive. Click on the Motion button and select the SCL operating mode. The numerals 0..9 or the special characters : ; < = > ? may be used as addresses. Make sure each drive on the network has a unique address. Once the address has been assigned, click Download to save the settings to the drive.

Address	SCL Character	Address	SCL Character
0	0	8	8
1	1	9	9
2	2	A	:
3	3	B	;
4	4	C	<
5	5	D	=
6	6	E	>
7	7	F	?

3.4 IO Control and Function Description

1	+5V USER	2	GND
3	X1	4	Y1+
5	X2	6	Y1-
7	X3	8	Y2+
9	X4	10	Y2-
11	X5	12	AH
13	X6	14	Analog In
15	X7	16	AL
17	X8	18	INCOM

PIN NUM	SIGNAL TYPE	SIGNAL NAME		FUNCTION
		BASIC	GENERAL	BASIC
1	POWER SUPPLY	+5V USER		The drive provides users with up to 100mA +5V supply
2		GND		External control signal GND
18		INCOM		External opto-coupler power input (common anode or common cathode connection can dial to select)
3	INPUT	CW/CCW	X1	Clockwise/Counter Clockwise Select
5		STMD (STOP MODE)	X2	Stop mode choice input
7		EN/RE (Enable/Reset)	X3	Motor enable/disable. It can be used for alarm reset as well.
9		SPST (SPEED-SET)	X4	Internal/external speed-set choice
11		STOP	X5	The electromagnetic brake operation is selected when the motor is stopped.
13		M0	X6	For multi-speed operation, the M0, M1, M2 signals are used in combination.
15		M1	X7	
17		M2	X8	
12	ANALOG INPUT	Analog VCC	-	Using external speed potentiometer setting speed
14		Analog In	-	
16		Analog GND	-	

4	OUTPUT	Fault+	Y1+	Fault output
6		Fault-	Y1-	
8		Speed Out+	Y2+	6 pulses are output per each rotation of the motor output shaft. It can be changed by BLD configurator.
10		Speed Out-	Y2-	
-		MOVE	-	This signal is output during motor rotation.
-		VA	-	Output a signal as speed achieved
-		Fault2	-	This signal is output when the overload warning level is exceed when the overload warning function is set to enable. In addition, also outputs if an overload alarm is generated even when the overload warning function is set to disable (normally closed).
-		Warning	-	This signal is output if a warning is generated (overload warning function is activated)While, it turns OFF if the warning is released.
-		TLC	-	This signal is output when the motor output-torque reaches the torque limiting value.
-		IDLE	-	Configuring as general output

*1 Expand output functions are set through software configuration.

*2 the control module may be used to assign the required signals out of the eight input terminals (X1 to X8) and the two output signal terminals (Y0 and Y1).

Y1-Y2 can be allocated as: Fault/Speed Out/MOVE/VA/Fault2/Warning/TLC/IDLE. (8 in total)

Input Signals Description

The signal state represents the “ON: Carrying current” or “OFF: Not carrying current” state of the internal photocoupler rather than the voltage level of the signal.

CW/CCW

Switching the CW input will cause the motor to turn clockwise as viewed from the motor shaft, while switching to the CCW input will cause the motor to turn counterclockwise. The starting acceleration is set by the acceleration potentiometer (ACC/DEC) or command.

STMD (STOP MODE)

When STOP-MODE is OFF, the motor will stop according to the deceleration set by the acc/dec potentiometer. When STOP-MODE is ON, it will stop the motor using electromagnetic brake operation.

EN/RE (Enable/Reset)

When ENABLE is ON, the motor will be energized .When ENABLE is OFF, the motor will be deenergized. Regardless any other input states, ENABLE being OFF has the highest priority, so that it can be used as emergency stop. By disabling and enabling the drive, it can be reset.

SPST(Speed-set)

OFF Internal speed setting

ON External analog signal setting

Multi-speed operation (M0,M1,M2)

8 kinds of speed is available with M0, M1, M2 input. (Speed control mode and position control mode share the same function)

Default operating data	Operating speed selection			Speed setting method
	M0	M1	M2	
0rpm	OFF	OFF	OFF	Internal speed setting
500rpm	ON	OFF	OFF	Digital setting
1000rpm	OFF	ON	OFF	Digital setting
2000rpm	ON	ON	OFF	Digital setting
3000rpm	OFF	OFF	ON	Digital setting
3500rpm	ON	OFF	ON	Digital setting
4000rpm	OFF	ON	ON	Digital setting
4500rpm	ON	ON	ON	Digital setting

STOP

When STOP is on, the motor stops in the mode set by STMD.

Output Signal Description

FAULT

FAULT output an error signal when the drive is over-heat, over-current, over-voltage, under-voltage or internal voltage bad. The output voltage of error signal can be defined by SCL command AO.

SPEED OUT

The motor output shaft output

6*(pole pairs) per revolution(default). And the pulse number can be set through the software.

MOVE

This signal is output during motor rotation.

VA

Speed reached command. If the difference between the actual motor speed and the input speed reaches specified range, the drive will output this signal. The difference range can be defined in 0~+/-400rpm (the default range is +/-200rpm).

FAULT2

In order to avoid overload, the drvie can set the overload level, and use it as overload alarm signal. With this signal, user can distinguish the real cause of fault or warning.

Warning

When communication error occurs or back EMF voltage is over range, a warning will happen till the error is eliminated.

TLC

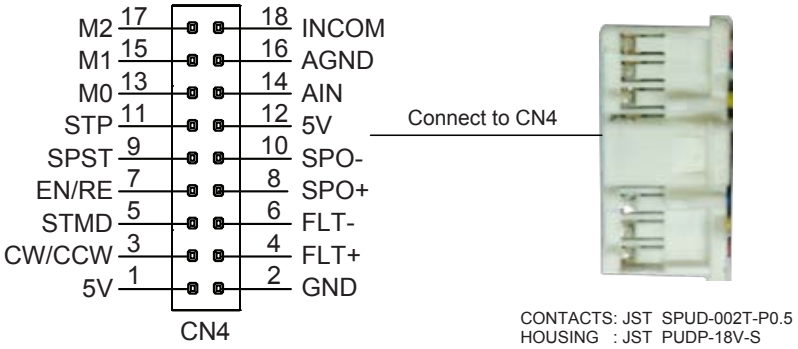
When the output torque reaches the rated limi, the output is ON.

IDLE

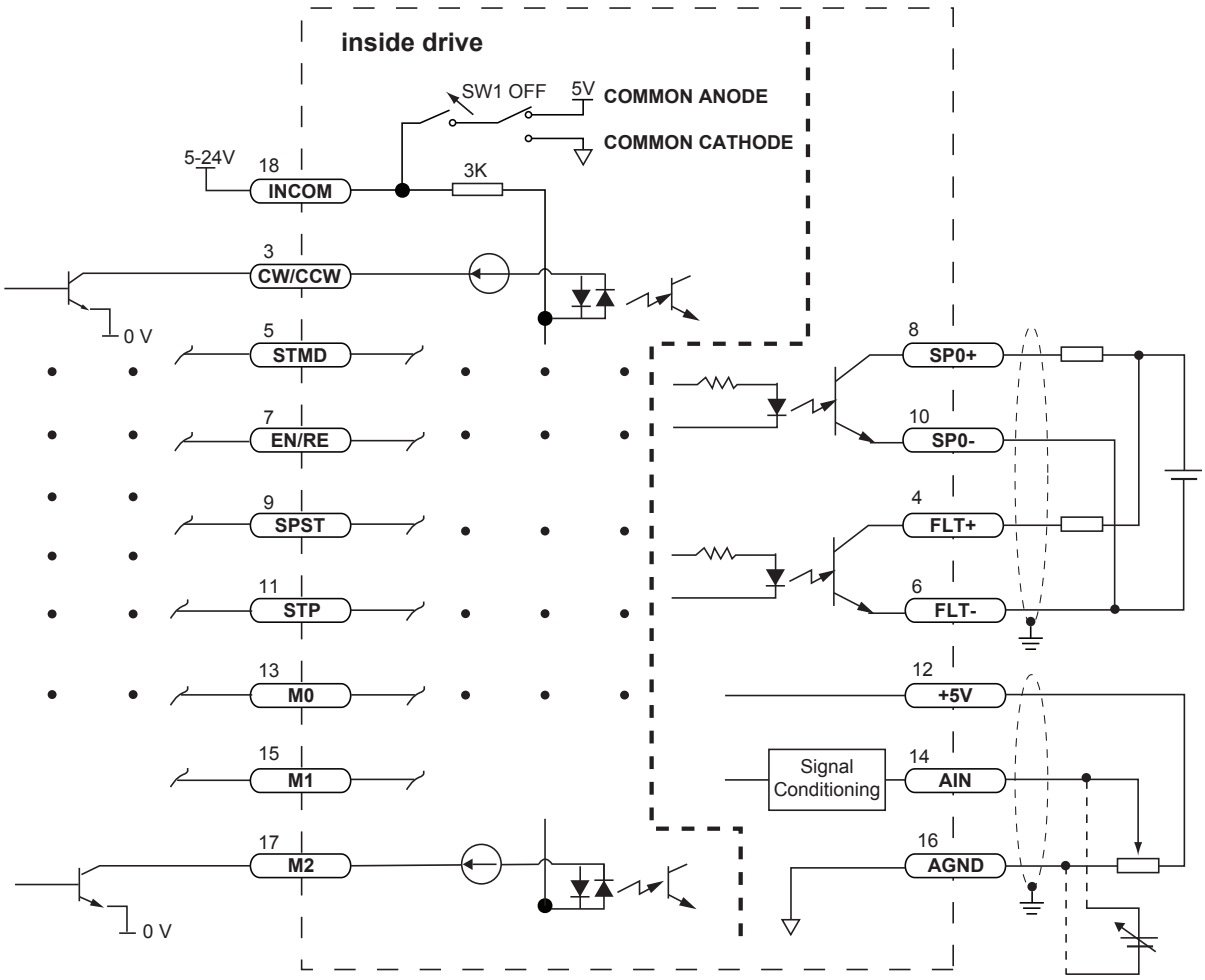
IDLE can be configured as a general output when idle.

3.5 Connecting the Inputs and Outputs(CN4)

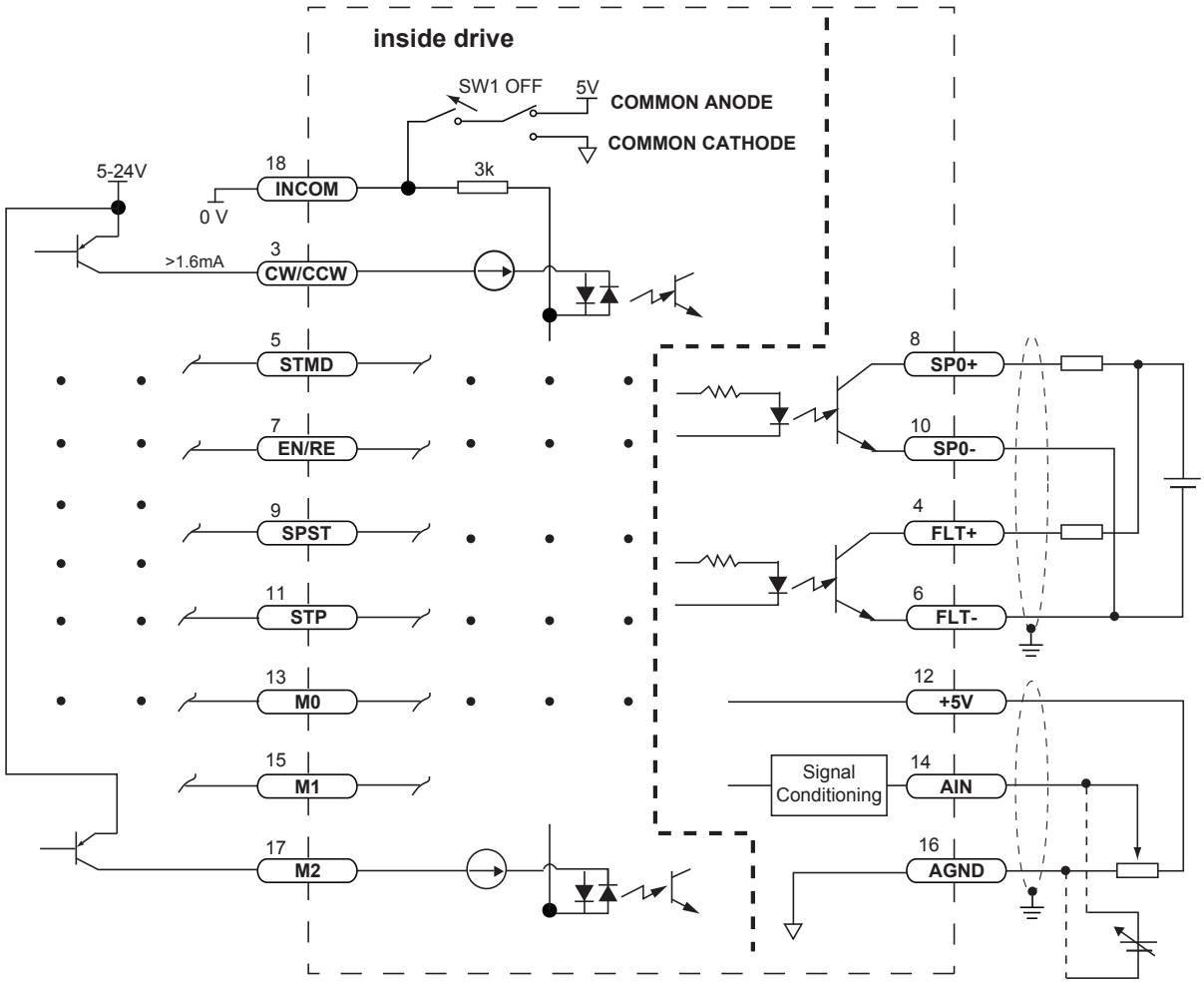
The connector is an 18-Pin board-to wire connector with secure locking device and designed to 2.0 mm pitch, crimping style and double-row. The pin-out is as follows:



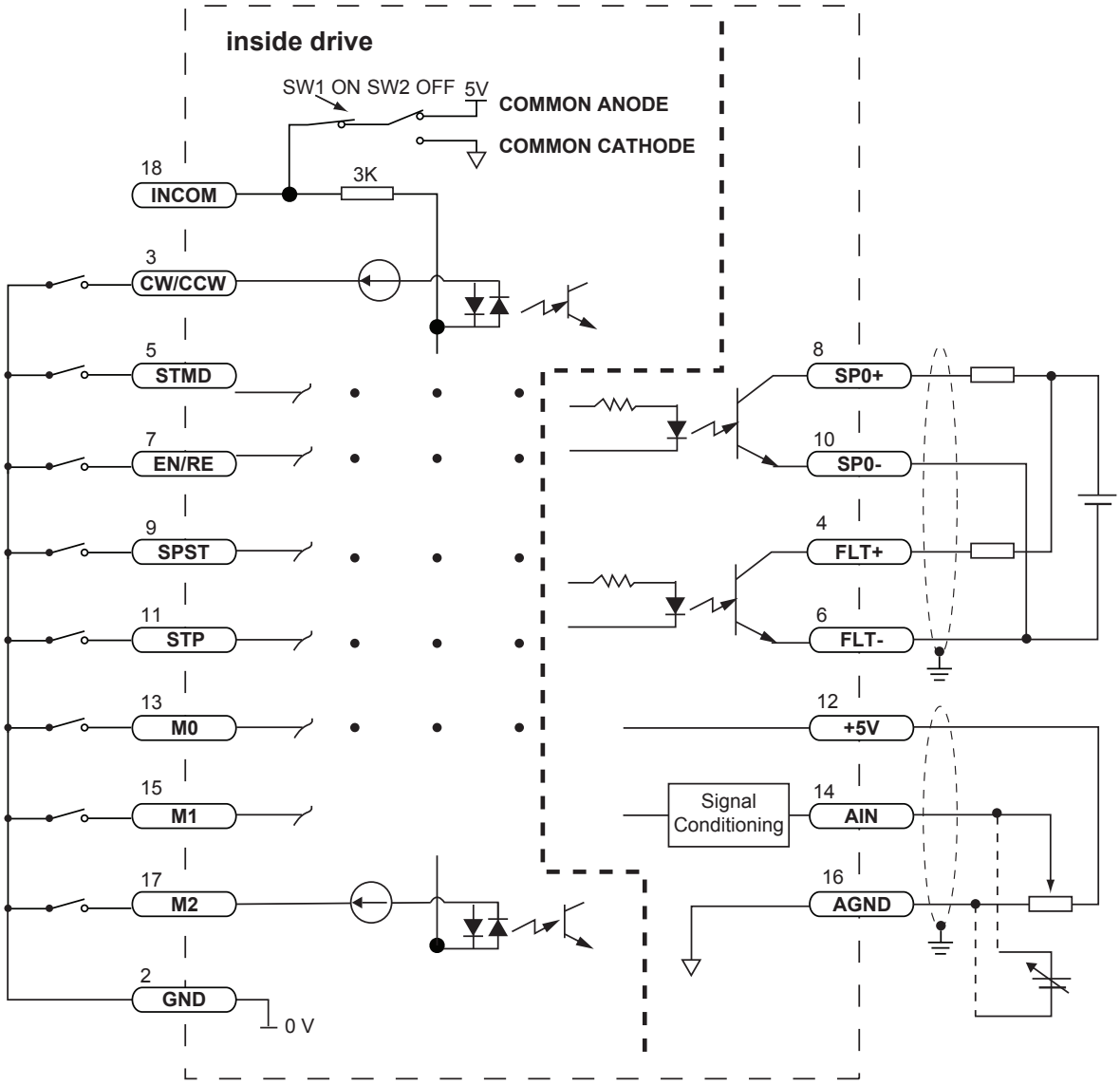
3.5.1 Input Connection



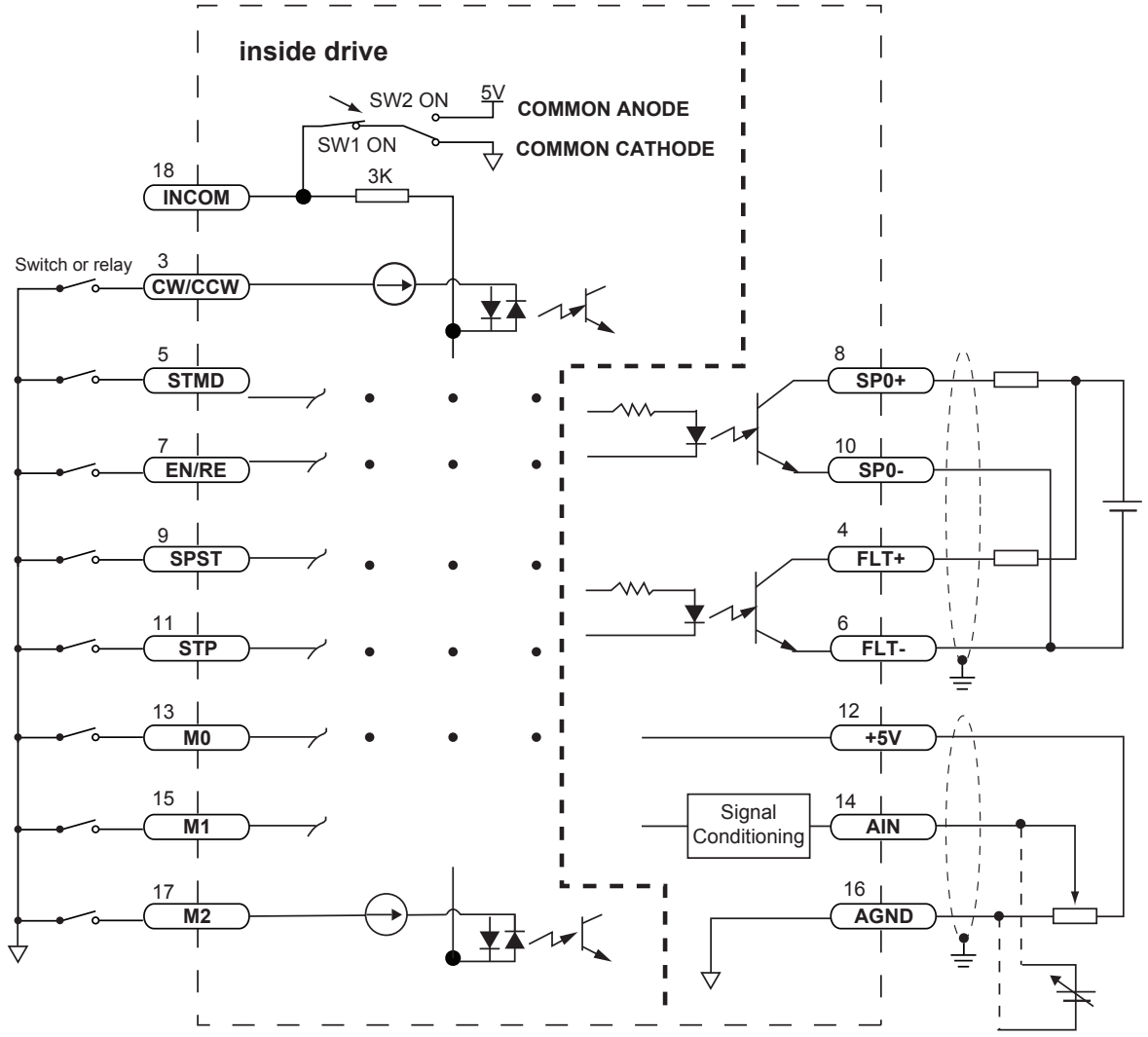
Connecting to control IO with external Sinking Outputs



Connecting to control IO with external Sourcing Outputs



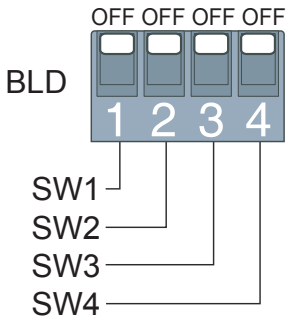
Connecting to control IO with internal Sinking Outputs



Connecting to control IO with internal Sourcing Outputs

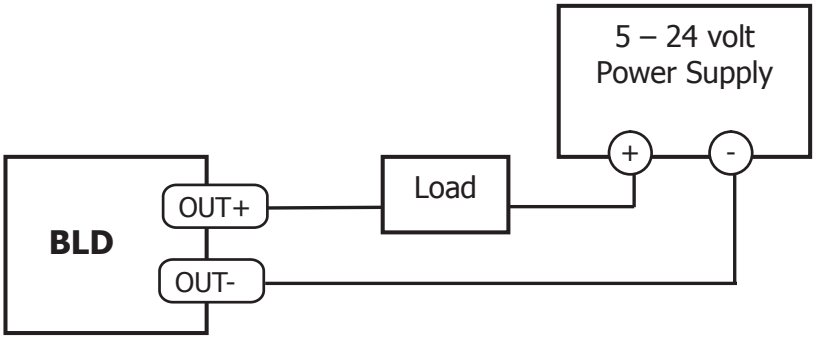
3.5.2 Dip Switches

At the right side of BLD drive there are four switches. If users don't want use external power for the IO control, they can switch SW1 "ON" to choose the internal 5V power supply to IO control and "OFF" means external power supply. When SW1 is "ON", user should chose common anode or common cathode control by SW2. SW2 is "ON" that means user chose common anode IO control. SW2 is "OFF" that means user chose common cathode IO control.

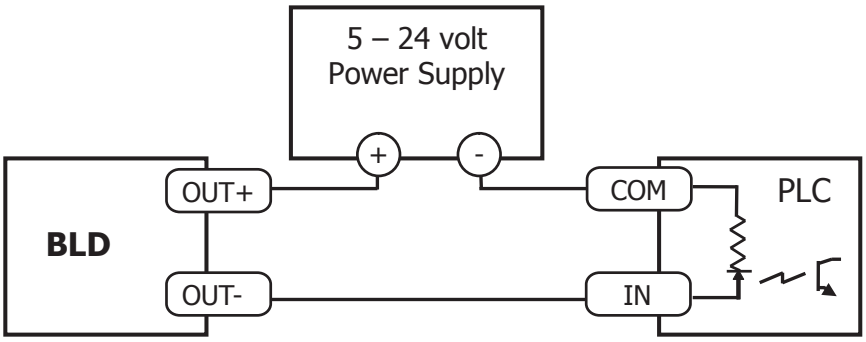


For RS485 version, SW4 is "ON" that means there is a 120 ohm termination resistor across the TX+ and TX- terminals. SW3 is reserved.

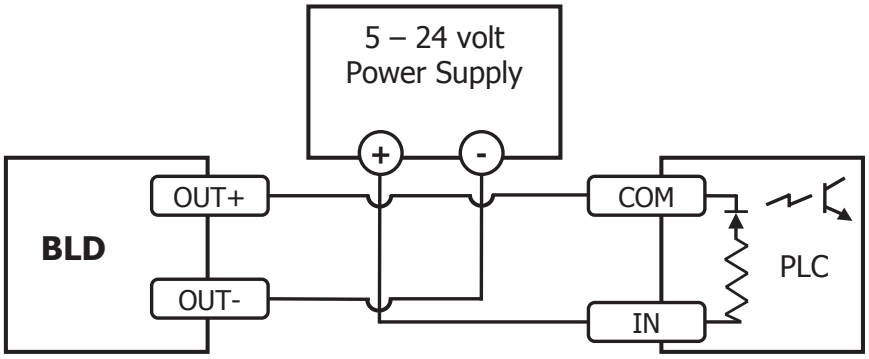
3.5.3 Output Connection



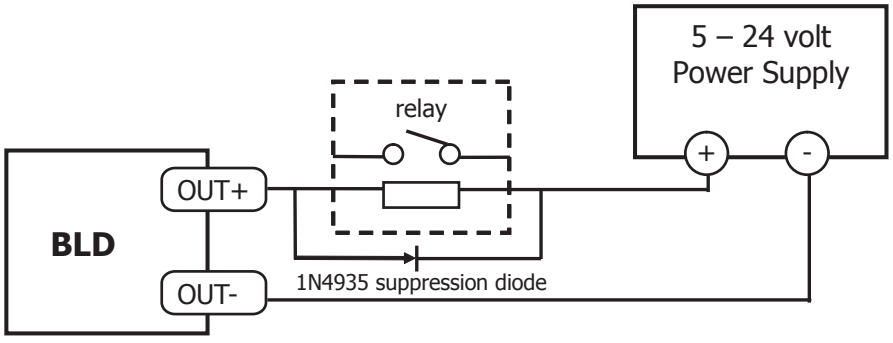
Connecting a Sinking Output



Connecting a Sourcing Output

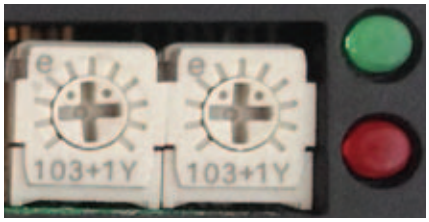


Connecting a Sourcing Output again



Driving a Relay

3.6 Two Potentiometers(RS232 Only)



ACC/DEC SPEED

3.6.1 Speed Setting

This one potentiometer can be used for adjusting speed. The velocity range can be setting in BLD configurator. Its default range is 150 to 4500rpm.

3.6.2 Acceleration Setting

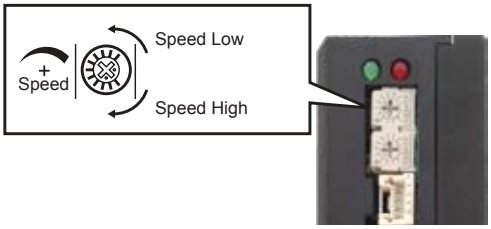
This one potentiometer can be used for adjusting acceleration and deceleration. The acceleration and deceleration range are the same and can be setting in BLD configuration. Their default range are 0 to 3000rps^2

3.7 Status LED Codes

Code		Error
🟢	Solid Green	Motor Disabled
🟢🟢	Flashing Green	Motor Enabled
🔴🟢🟢	1 Red, 2 Green	Can't Move (Disabled)
🔴🔴🔴🟢	3 Red, 1 Green	Drive Over Temperature
🔴🔴🔴🟢🟢	3 Red, 2 Green	Bad Internal Voltage
🔴🔴🔴🔴🟢	4 Red, 1 Green	Supply Voltage High
🔴🔴🔴🔴🟢🟢	4 Red, 2 Green	Supply Voltage Low
🔴🔴🔴🔴🔴🟢	5 Red, 1 Green	Over Current
🔴🔴🔴🔴🔴🟢🟢	5 Red, 2 Green	Over Load
🔴🔴🔴🔴🔴🔴🟢	6 Red, 1 Green	Open Motor Phase
🔴🔴🔴🔴🔴🔴🟢🟢	6 Red, 2 Green	Bad Hall Signal
🔴🔴🔴🔴🔴🔴🔴🟢	7 Red, 1 Green	Comm Error
🔴🔴🔴🔴🔴🔴🔴🟢🟢	7 Red, 2 Green	Save Failed

4 Operation

4.1 Basic operation



Speed setting

- **The setting range is 150 to 4500 rpm.**

Setting by internal potentiometer.
Use a precision screwdriver to turn the internal potentiometer.
Turn the potentiometer clockwise to increase the speed.
Factory setting: 0 r/min

- **Setting by the external potentiometer**

Connect the external potentiometer to the I/O signal connector (CN4) of the driver.
The recommended resistor is 5kΩ.
Connect the shield wire of the signal wire to the AGND input terminal.
Make sure the shield wire does not contact other terminals.
When the M0,M1,M2 input is turned OFF and the SPST terminal is turned ON, the external potentiometer is enabled. Turn the potentiometer clockwise to increase the speed.

- **Setting with external IO input voltage**

Setting SW1 OFF, then 5 -24 VDC for the external IO input DC voltage can be used.

Factory setting: SW1 OFF

Note Change the setting of the external voltage selector switch SW1 before turning on the power.

Running/stopping the motor

Run/stop the motor by inputting operation control signals.

- **Operation**

When the CW/CCW input is turned OFF, the motor turns in the clockwise direction according to the acc/dec potentiometer setting. When the CW/CCW input is turned ON, the motor turns in the counterclockwise direction according to the acc/dec potentiometer setting.

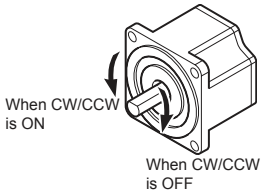
- **Stop**

When the STMD input is turned OFF and the STP input is turned ON, the motor stops according to the acc/dec potentiometer setting. It maybe produce Back-EMF and make the drive alarm “Supply voltage high“.

When the STMD input is turned ON and the STP input is turned ON, the motor stops by short all the three phase of the motor. It will stop the motor very fast without Back-EMF. This stopping method is recommended.

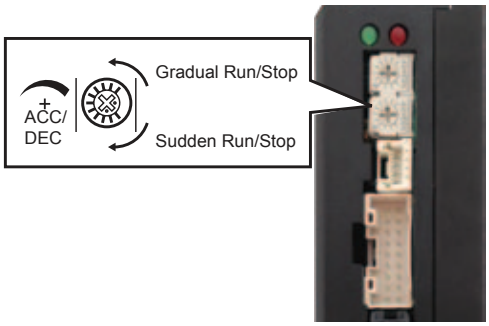
Rotating direction of the motor output shaft

The rotating direction of the motor output shaft represents the direction when viewed from the motor output shaft side.



4.2 Setting the acceleration and deceleration

You can set the acceleration and deceleration for starting and stopping.
The acceleration and deceleration are effective for all speed settings.



5 Motor

According to the rated current value to select the BLD drive. The value is above 5Arms, please select to the BLD10 drive. The value is below or equal to 5Arms, please select to the BLD5 drive.

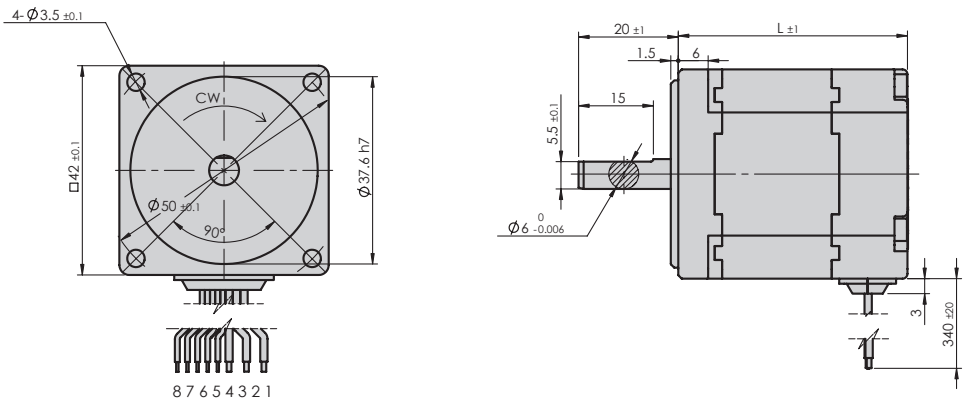
BLD5/10 drive support all the 42 and 57 BLDC motor as follow.

42 BLDC MOTOR

Technical Specification

	Symbols	Units	Type					
			42BL30L2	42BL30L4	42BL60L2	42BL60L4	42BL105L2	42BL105L4
		mm	42	42	42	42	42	42
Length	L	mm	46	46	70	70	100	100
Input voltage	Un	VDC	24	48	24	48	24	48
Rated power	Pn	W	30	30	60	60	105	105
Phase number	P		3					
Rated speed	Nn	RPM	4500	4500	4500	4500	4500	4500
Max. speed	Np	RPM	5500	5500	5500	5500	5500	5500
Rated torque	T	mNm	65	65	130	130	225	225
Max. torque	Tmax	mNm	130	130	300	260	450	450
Rated current	I	Arms	1.75	0.9	3.6	1.8	6.25	3.2
Max. current	Imax	Arms	3.5	1.8	7.2	3.6	12.5	6.4
Voltage constant±10%		Vrms/Krpm	2.65	5	2.7	5.2	2.65	5.5
Torque constant±10%		Nm/Arms	0.037	0.075	0.037	0.075	0.037	0.075
Moment of inertia		10^-4kgm^2	0.0388	0.0388	0.072	0.072	0.114	0.114
Resistance±10%（25℃）	R	Ω	1.03	3.4	0.45	1.73	0.25	0.83
Inductance	L	mH	0.90	3.15	0.44	1.65	0.25	1
Sensor	Hall							
Ins.class	E							
Protective rating	IP40							
Operating temperature	0~+50 ℃ (storage temperature -20~+60℃)							
Operating RH	85% RH or below (noncondensing)							
Operating environment	Outdoor (no direct sunlight), no corrosive gas, no flammable gas, no oil mist, no dust							
Altitude	1000m or below							

Dimensions

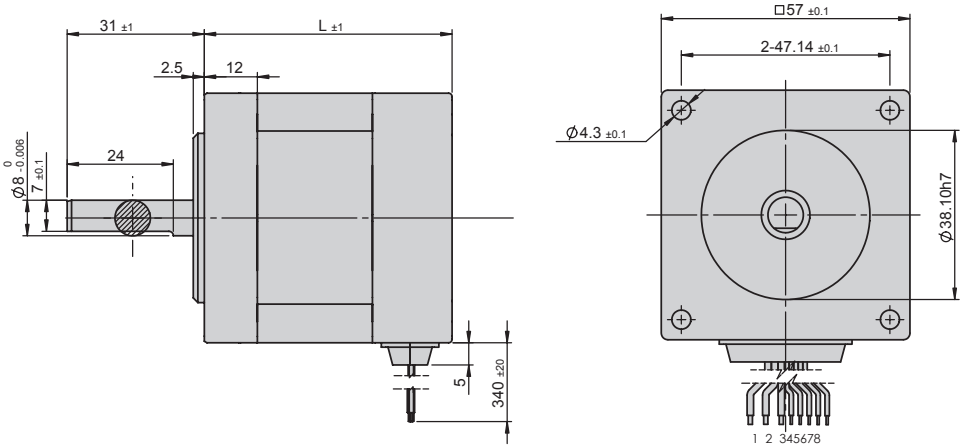


57 BLDC MOTOR

Technical Specification

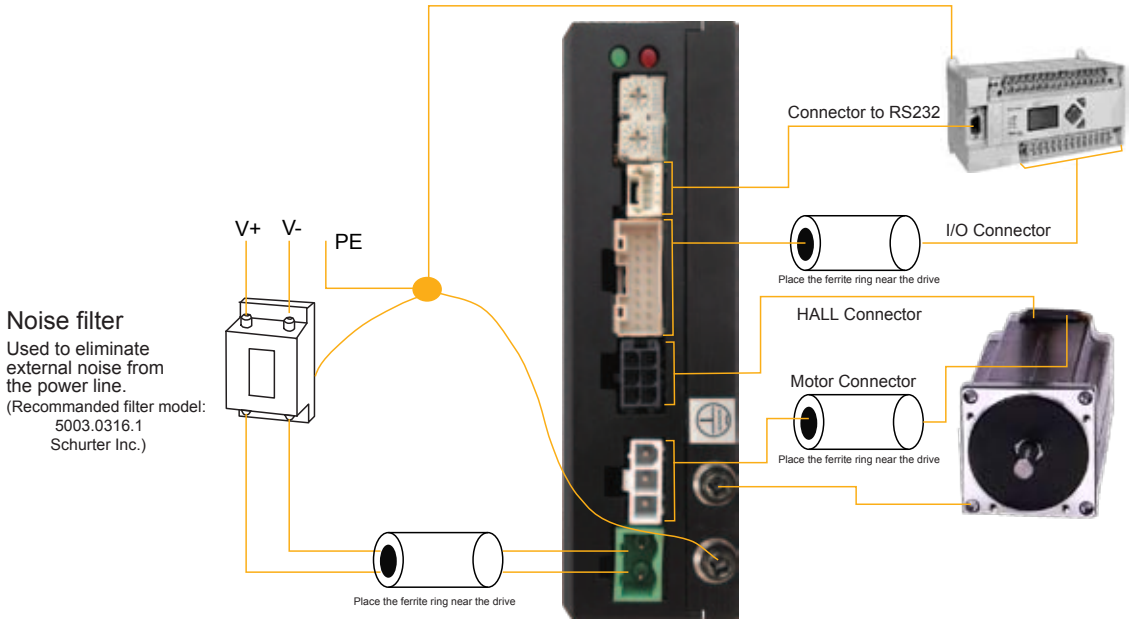
	Symbols	Units	Type				
			57BL60L2	57BL60L4	57BL120L2	57BL120L4	57BL200L4
		mm	57	57	57	57	57
Length	L	mm	54	54	82	82	120
Input voltage	Un	VDC	24	48	24	48	48
Rated power	Pn	W	60	60	120	120	200
Phase number	P		3				
Rated speed	Nn	RPM	4000	4000	4000	4000	4000
Max. speed	Np	RPM	5000	5000	5000	5000	5000
Rated torque	T	mNm	145	145	290	290	480
Max. torque	Tmax	mNm	220	300	600	600	960
Rated current	I	Arms	3.55	1.6	6.3	3.1	5.8
Max. current	Imax	Arms	5.33	3.3	13	6.5	102
Voltage constant±5%		Vrms/Krpm	3.00	5.6	3.0	5.5	6.0
Torque constant±5%		Nm/Arms	0.041	0.09	0.046	0.09	0.09
Moment of inertia		10^-4kgm^2	0.148	0.167	0.279	0.293	0.456
Resistance±10%（25℃）	R	Ω	0.46	1.05	0.18	0.54	0.36
Inductance	L	mH	0.44	1.25	0.18	0.64	0.48
Sensor	Hall						
Ins.class	E						
Protective rating	IP40						
Operating temperature	0~+50 ℃ (storage temperature -20~+60℃)						
Operating RH	85% RH or below (noncondensing)						
Operating environment	Outdoor (no direct sunlight), no corrosive gas, no flammable gas, no oil mist, no dust						
Altitude	1000m or below						

Dimensions



6 Setup for EMC

For the EMC/EMI requirement, ferrite ring and DC EMI filter are recommended.
The power input interface can use ferrite ring to reduce the radiation emission. The DC EMI filter can reduce the radiation emission better than ferrite ring.
The shield wires are recommended for the IO input and its shield should be connected to the earth terminal of the BLD drive.



7 Host Command

In RS485 version user need to add {address} before the command for point to point communication. If using broadcast communication, the {address} may be removed. This is not required for RS-232 communications.

Examples:

Command	Drive sends	Notes
5CC4.50	-	Set address 5 drive continuous current to 4.5 amps rms
5CC	CC=4.5	

AD - Analog Deadband

Affects: Analog input

Sets or requests the analog deadband value in millivolts. The deadband value is the zone around the "zeroed" value of the analog input. This deadband defines the area of the analog input range that the drive should interpret as "zero". This zero point can be used as the zero velocity point in analog velocity. The deadband is an absolute value that in usage is applied to either side of zero volts.

Command Details:

Structure	AD{Parameter #1}
Usage	READ/WRITE
Non-Volatile	YES

Parameter Details:

Parameter #1	Analog deadband
- units	mV
- range	0~255, Default Value: 0

Examples:

Command	Drive sends	Notes
AD100	-	Set analog deadband to 0.1 volts
AD	AD=100	

AF - Analog Filter

Affects: All commands using the analog inputs
See also: IA commands

Applies a digital filter to the analog input(s). This is a simple single pole filter that rolls off the analog input. The filter value of the AF command is related to the desired value of the analog filter in Hz by the following equation:

Filter value = 72090/(3500/f + 2.2)
where f = desired value of the analog filter in Hz

Command Details:

Structure	AF{Parameter #1}
Usage	READ/WRITE
Non-Volatile	YES

Parameter Details:

Parameter #1	Filter value
- units	integer (see formula above)
- range	0 - 32767* (0 disables the filter)

Examples:

Command	Drive sends	Notes
AF2059	-	Make the analog input bandwidth 100.006Hz
AF	AF=2059	

AL - Alarm Code

See also: AR commands, Appendix

Reads back an equivalent hexadecimal value of the Alarm Code's 16-bit binary word.

Command Details:

Structure	AL
Usage	READ ONLY
Non-Volatile	NO
Units	Hexadecimal value of 16-bit binary word (see below)

Response Details:

Hex Value	Details
0x0008	OVER_TEMPERATURE
0x0010	INTERNAL_VOLTAGE
0x0020	VOLTAGE_HIGH
0x0040	VOLTAGE_LOW
0x0080	OVER_CURRENT
0x0100	OPEN_WINDING
0x0200	HALL_BAD
0x0400	COMM_ERROR
0x0800	SAVE_FAILED
0x1000	DRIVE_DISABLED
0x2000	CURRENT_LIMIT
0x4000	NV_MEMORY_ERROR

AR - Alarm Reset

Affects: Alarm Code
See also: AL, ME, MD commands

Clears Alarms and Drive Faults. If an Alarm or Drive Fault condition persists after sending the AR command the Alarm is not cleared.

NOTE: The command does not re-enable the drive. Use ME (Motor Enable) command to re-enable drive.

Command Details:

Structure	AR
Usage	WRITE ONLY
Non-Volatile	NO

Examples:

Command	Drive sends	Notes
AR	-	Reset Drive Fault and clear Alarm Code (if possible)

AV - Analog Offset Value

Affects: All Analog input functions
See also: AF commands

Sets or requests the analog offset value in volts.

Command Details:

Structure	AV{Parameter #1}
Usage	READ/WRITE
Non-Volatile	YES

Parameter Details:

Parameter #1	Analog offset
- units	mV
- range	0~5000, Default Value: 0

Examples:

Command	Drive sends	Notes
AV250	-	Set analog offset to 250Volts
AV	AV=250	

CC - Change Current

Affects: Motor current and torque
See also: CP commands

Sets or requests the maximum continuous (RMS) current setting of the BLD drive.

Command Details:

Structure	CC{Parameter #1}
Usage	READ/WRITE
Non-Volatile	YES

Parameter Details:

Parameter #1	Continuous current setting
- units	amps rms (resolution is 0.01 amps)
- range	BLD5: 0-5 BLD10:0-10

*Current setting in drives depends on the selected motor. Use Configurator software to select a motor and set the maximum current setting.

Examples:

Command	Drive sends	Notes
CC4.50	-	Set continuous current to 4.5 amps rms
CC	CC=4.5	

CJ - Commence Jogging

See also: JS, JA, JL, SJ, CS commands.

Starts the motor jogging. The motor accelerates up to the jog speed (JS) at a rate defined by the jog accel (JA) command, then runs continuously until stopped. To stop jogging, use the SJ (Stop Jogging) command for a controlled decel rate (decel rate set by JL command). For a faster stop, use the ST command, but beware that if the speed or load inertia is high, the drive may fault. Use the CS command to change jog speed and direction while already jogging. CS does not affect JS.

Command Details:

Structure	CJ
Usage	WRITE ONLY
Non-Volatile	NO

Examples:

Command	Drive sends	Notes
JA10	-	Set jog accel to 10 rps/s
JL25	-	Set jog decel to 25 rps/s
JS1	-	Set jog speed to 1 rps
CJ	-	Start jogging with speed set by last JS command
CS10	-	Change jog speed to 10 rps
SJ	-	Stop jogging using decel rate set by last JL command

DA - Define Address

Affects: Drive address for multi-drop communications

Gets individual drive address character for multi-drop RS-485 communications. This command is not required for RS-232 communications.

Command Details:

Structure	DA{Parameter #1}
Usage	READ ONLY
Non-Volatile	NO

Parameter Details:

Parameter #1	RS-485 network address
- units	character
- range	Valid address characters are: ! " # $ % & ' ( ) * + , - . / 0 1 2 3 4 5 6 7 8 9 : ; < > ? @

Examples:

Command	Drive sends	Notes
DA	DA=1	

GR - Group Define

Affects: Define drive group for multi-drop communications

Define individual drive into one group for multi-drop RS-485 communications. This command is not required for RS-232 communications.

Command Details:

Structure	{Address}GR{Parameter #1}
Usage	READ/WRITE
Non-Volatile	YES

Parameter Details:

Parameter #1	Group drives
- range	a~z, Default Value: a

Examples:

Command	Drive sends	Notes
5GRa	-	Address 5 drive is grouped into a group

IA - Immediate Analog

See Also: AD, AV commands

Requests present analog input value from the given source. There are three different analog values that can be accessed. With no parameter the IA command returns the Analog Command value which is derived from the analog inputs with gain and offset values applied as set in Configurator or via the AD, AV commands. When a parameter is given raw (unscaled) analog input values are returned.

Command Details:

Structure	IA{Parameter #1}
Usage	READ ONLY
Non-Volatile	NO

Parameter Details:

Parameter #1	Analog input
- units	integer
- range	No parameter or 0 =Internal speed analog 1 = Acceleration/Deceleration analog 2 = External speed analog

Examples:

Command	Drive sends	Notes
IA	IA=2.5	Analog Command is at mid range when drive is set to 0-5 volt input
IA1	IA=4.99	Analog input 1 is near 5 volts

IC - Immediate Current (Commanded)

Requests the present RMS current commanded by the servo loop. This may not be the actual current at the motor windings. Most BLDC motors are commutated using a sinusoidal current waveform that is a “peak” value and not directly represented by the commanded current. The commanded current is the average RMS current being asked of the driver. Typically with a well tuned current loop the RMS current in the servo motor is well represented by this value.

Command Details:

Structure	IC
Usage	READ ONLY
Non-Volatile	NO
Units	0.01 amps

Examples:

Command	Drive sends	Notes
IC	IC=3.5	3.5 amps
IC	IC=-3.5	-3.5 amps

IO - Output Status

With no parameter this command requests the immediate status of the designated outputs. The status is displayed as an 8-bit binary number with output 1 in the far right position (bit 0). With a parameter this command sets the outputs high or low using the decimal equivalent of the same binary pattern. Logic zero ("0") turns an output on by closing it.

An optional "Y" in Parameter #1 is used to designate outputs on the IN/OUT 1 connector of BLuAC or STAC drives, or the main driver board connector (DB-25) of BLuDC drives.

Command Details:

Structure	IO{Parameter #1}
Usage	READ/WRITE
Non-Volatile	NO

Parameter Details:

Parameter #1	Decimal equivalent of binary output pattern
- units	integer
- range	0 - 3

Examples:

BLu and STAC6-S or -Q versions (optional "Y" character is not necessary)

Command	Drive sends	Notes
IO	IO=00000000	All 2 outputs of IN/OUT1 or main board are low (closed)
IO	IO=00000011	All 2 outputs of IN/OUT1 or main board are high (open)
IO0	-	Sets all 2 outputs low (closed)
IO3	-	Sets all 2 outputs high (open)

NOTE: When working with digital inputs and outputs it is important to remember the designations low and high. If current is flowing into or out of an input or output, i.e. the circuit is energized, the logic state for that input/output is defined as low or closed. If no current is flowing, i.e. the circuit is de-energized, or the input/output is not connected, the logic state is high or open.

IS - Input Status

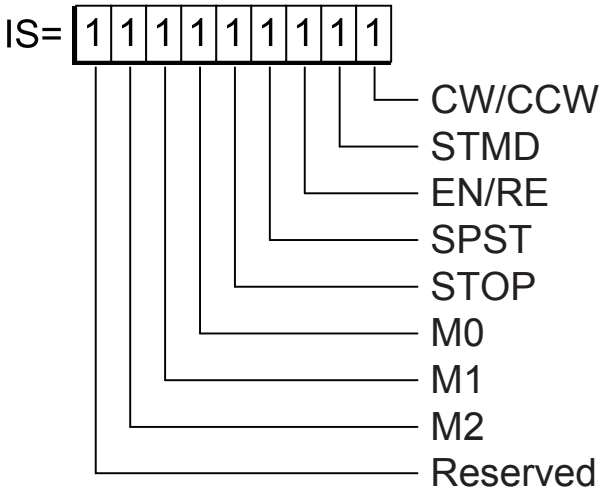
Requests immediate status of all drive inputs. A closed input is represented by a “0” (zero), and an open input is represented by a “1” (one). Unused positions in the response are represented by “0” (zero).

The IS command requests the status of inputs X1 through X8 plus the SW3 switch ON/OFF status

Command Details:

Structure	IS{Parameter #1}
Usage	READ ONLY
Non-Volatile	NO

Response Details:



Examples:

Command	Drive sends	Notes
IS	IS=100110110	Inputs 1, 4, 7, and 8 are closed
IS	IS=011111111	Encoder index channel is closed

NOTE: When working with digital inputs and outputs it is important to remember the designations low and high. If current is flowing into or out of an input or output, i.e. the circuit is energized, the logic state for that input/output is defined as low or closed. If no current is flowing, i.e. the circuit is de-energized, or the input/output is not connected, the logic state is high or open.

IT - Immediate Temperature

Requests present value of the temperature sensor on the main driver board. The temperature reads out in 0.1 degrees Centigrade resolution. The drive will fault when the temperature reaches a specified maximum value. (See hardware manuals for details).

Command Details:

Structure	IT
Usage	READ ONLY
Non-Volatile	NO
Units	0.1 deg C

Examples:

Command	Drive sends	Notes
IT	IT=275	Drive temperature is 27.5 C°
IT	IT=310	Drive temperature is 31.0 C°

IU - Immediate Voltage

Requests present value of the DC bus voltage, +/-5%. The voltage reads out in 0.1 volts resolution. The drive will fault when the DC bus voltage reaches a specified maximum value. An Alarm will be set when the DC Bus voltage is less then a minimum value. (See hardware manuals for details).

Command Details:

Structure	IU
Usage	READ ONLY
Non-Volatile	NO
Units	0.1 Volts DC, +/-5%

Examples:

Command	Drive sends	Notes
IU	IU=482	DC supply voltage is 48.2 Volts

IV - Immediate Velocity

Requests present velocity of the motor in rpm.

Command Details:

Structure	IV
Usage	READ ONLY
Non-Volatile	NO

Examples:

Command	Drive sends	Notes
IV	IV=1000	BLDC motor is running at 1000 rpm

JA - Jog Acceleration

Affects: CJ commands
See also: CJ, CS, JL, JS, SJ

Sets or requests the accel/decel rate for Jog moves in rev/sec/sec. Sending JA with no parameter causes drive to respond with present jog accel/decel rate. Setting JA overwrites the both the last JA and JL values. This means that to have different jog accel and jog decel values, you should first send JA to set the jog accel and then send JL to set the jog decel. The JA value cannot be changed while jogging.

Command Details:

Structure	JA{Parameter #1}
Usage	READ/WRITE
Non-Volatile	Yes

Parameter Details:

Parameter #1	Jog acceleration value
- units	rev/sec/sec (rps/s)
- range	0.167 to 5461.167 (resolution is 0.167 rps/s)

Examples:

Command	Drive sends	Notes
JA100	-	Set jog acceleration to 100 rev/sec/sec
JA	JA=100	

JL - Jog Decel

Affects: Jogging during velocity modes, and CJ command
See also: JA command

Sets or requests the decel rate for Jog moves and velocity modes in rev/sec/sec.

Command Details:

Structure	JL{Parameter #1}
Usage	READ/WRITE
Non-Volatile	YES

Parameter Details:

Parameter #1	Jog deceleration rate
- units	rev/sec/sec (rps/s)
- range	0.167 - 5461.167 rps/s (resolution is 0.167 rps/s)

Examples:

Command	Drive sends	Notes
JL25	-	Sets jog deceleration rate to 25 rps/s
JL	JL=25	

JS - Jog Speed

Affects: Jogging during, velocity modes, and CJ command
See also: CJ, CS, JA commands

Sets or requests the speed for Jog moves in rev/sec. Sending JS with no parameter causes drive to respond with present jog speed.

Command Details:

Structure	JS{Parameter #1}
Usage	READ/WRITE
Non-Volatile	Yes

Parameter Details:

Parameter #1	Move velocity
- units	rev/sec
- range	-130 to 130 (resolution is 0.0042)

Examples:

Command	Drive sends	Notes
JS10.35	-	Set jog speed to 10.35 rps
JS	JS=10.35	

MD - Motor Disable

Affects: All motion commands
See also: ME commands

Disables motor outputs (reduces motor current to zero).

Command Details:

Structure	MD
Usage	WRITE ONLY
Non-Volatile	No

Examples:

Command	Drive sends	Notes
MD	-	Drive turns off current to the motor

ME - Motor Enable

Affects: All motion commands
See also: MD commands

Restores drive current to motor.

WARNING: This command restores the previous mode of operation. If for example the drive is operating in Analog Velocity mode the motor may immediately start moving. External inputs to the drive must be sequenced properly to avoid unpredictable operation.

Command Details:

Structure	ME
Usage	WRITE ONLY
Non-Volatile	NO

Examples:

Command	Drive sends	Notes
ME	-	Drive is enabled

MV - Model & Revision

Requests the connected drive's DSP firmware version, model number code, and sub-model number code (if applicable). The response from the drive is a single string of characters with no breaks or delimiters. The sequence of characters is firmware revision (3 numbers and 1 letter), model number code (3 numbers), sub-model number code (1 letter). See Response Details below.

Command Details:

Structure	MV
Usage	READ ONLY
Non-Volatile	No

Response Details:

Response will be in the format AAAABBBC, where AAAA is the firmware version, BBB is the model number code, and C is the sub-model number code. Model and sub-model number codes are listed below by drive, and Examples are given afterward.

Drive	Firmware	Model No. Code	Sub-Model No. Code
BLD5-A	*	139	A
BLD5-R	*	139	B
BLD10-A	*	140	A
BLD10-R	*	140	B

* See example below for format of firmware version.
- Denotes no sub-model number code is used for this drive.

Examples:

Command	Drive sends	Notes
MV	101G140A	Drive connected has DSP firmware version1.01G, and the drive model number is BLD10-A.

RE - Restart or Reset

Restarts the drive by resetting fault conditions and re-initializing the drive with the startup parameters. Leaves the drive in a disabled state to prevent any movement after the restart is complete.

Command Details:

Structure	RE
Usage	WRITE ONLY
Non-Volatile	NO

Examples:

Command	Drive sends	Notes
RE	-	Resets drive condition and parameters

SC - Status Code

Requests the current drive status as the Hexadecimal equivalent of a binary word. Each bit in the binary word relates to a status condition (see assignments below). The representation of this binary word as a hexadecimal value is called the Status Code. Drives can have multiple status conditions at one time, and host systems can typically interpret a Hexadecimal code very quickly.

Command Details:

Structure	SC
Type	TMMEDIATE
Usage	READ ONLY
Non-Volatile	NO
Register Access	None
Units	Hexadecimal equivalent of the binary status code word (see bit assignments below)

Response Details:

Hex Value	Status Code bit definition
0001	Enabled
0004	Fault
0020	Jogging
0040	Stopping
0200	Alarm

Examples:

Command	Drive sends	Notes
SC	SC=0004	Drive is faulted and disabled (hex value 0004)

SJ - Stop Jogging

Affects: CJ command
See Also: JA, CJ, ST commands

Stops the motor when jogging (CJ starts jogging). Jog decel rate is defined by the JA command.

Command Details:

Structure	SJ
Usage	WRITE ONLY
Non-Volatile	NO

Examples:

Command	Drive sends	Notes
SJ	- command	Stops jogging immediately using the deceleration rate set by the JL

SM - Stop Mode

See also: AM, JL, ST commands

Sets or gets the soft stop mode.
When using STD command to stop motion,

SM1: according to the JL value to stop motion.
SM0: according to the AM value to stop motion.

For RS232 version:

1. When using external IO control mode and using the analog speed (internal or external) to setting motion speed, using the SM command to stop motion,

   SM1: according to the JL value to stop motion.
   SM0: according to internal ACC/DEC analog value to stop motion.

2. When using external IO control mode and X2(STMD) is OFF, using the SM command to stop motion,

   SM1: according to the JL value to stop motion.
   SM0: according to internal ACC/DEC analog value to stop motion.

3. When using external IO control mode and X2(STMD) is ON, using the SM command to stop motion,

   SM0/SM1 will make the stop mode always using Regenerative braking to stop motion very fast without any Back-EMF.

For RS485 version:

1. When using external IO control mode and using the analog speed (internal or external) to setting motion speed, using the SM command to stop motion,

   SM0/SM1: always according to JL value to stop motion.

2. When using external IO control mode and X2(STMD) is OFF, using the SM command to stop motion,

   SM1: according to the AM value to stop motion.
   SM0: according to the JL value to stop motion.

3. When using external IO control mode and X2(STMD) is ON, using the SM command to stop motion, SM0/SM1 will make the stop mode always using Regenerative braking to stop motion very fast without any Back-EMF.

Command Details:

Structure	SM(Parameter #1)
Usage	READ/WRITE
Non-Volatile	YES

Parameter Details:

Parameter #1	Soft Stop Mode
- units	Integer
- range	integer: 0 =the deceleration is defined by AM. 1= the deceleration is defined by JL, Default Value:0

Examples:

Command	Drive sends	Notes
SM0	-	Stop motion immediately using the deceleration rate set by the JL command

ST - Stop

See Also: SM commands

ST command means stop motion with Regenerative braking.(fast stop without Back-EMF)
STD command means stop motion according to the SM command.

Command Details:

Structure	ST{Parameter #1}
Usage	WRITE ONLY
Non-Volatile	NO

Parameter Details:

Parameter #1	Deceleration rate
- units	letter
- range	D = deceleration rate set by DE or JA command no parameter = deceleration rate set by AM command

Examples:

Command	Drive sends	Notes
ST	-	Stop motion immediately using the Regenerative braking
STD	-	Stop motion immediately according to the SM command

VR - Velocity Error Range

Structure	VR{Parameter #1}
Usage	READ/WRITE
Non-Volatile	YES

Parameter Details:

Parameter #1	Deceleration rate
- units	integer
velocity	(rps)* 240
- range	0-1600, Default Value: 800

8 Specification

Drive Type	3-phase MOSFET bridge.
Current Control	D/Q sine current control
Output Current	BLD5: 0.1 — 5.0A/phase precision to 0.1A BLD10: 0.1 — 10.0A/phase precision to 0.1A
Supply Voltage	12-48VDC
Supply Voltage Type	DC
Max Power Input	10-70VDC
Control Modes	Velocity Control
Feedback	Halls
Setup Method	Switch / potentiometer
Digital Inputs	8
Digital Outputs	2
Analog Inputs	1 (0 to 5 Vdc, 12 bit)
Status LEDs	1 red, 1 green
Dimensions	3.9 x 2.6 x 1.2 inches
Weight	6.0 oz
Velocity Ripple	+/-0.5% Rated Velocity Error
Protection Function	Over voltage, under voltage, over temperature, short circuit (phase to phase, phase to grand), bad Hall signal.
Under Voltage Protection	10V
Over Voltage Protection	70V
Input Signal Voltage(IO)	5-24V
OUT Maximum Output Current	100mA
OUT Maximum Voltage	30V
Ambient Temperature	0 to 40°C
Storage Temperature	-10 to 70°C
Humidity	90% non-condensing

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